Oct 1-8:54 AM

3.7b Implicit Differentation

Show that dy/dx is defined at every point on the graph of $2y = x^2 + \sin(y)$

$2y' = 2x + y'\cos(y)$

$2y' - y'\cos(y) = 2x$

$y'(2-\cos(y)) = 2x$

$y' = \frac{2x}{2-\cos(y)}$

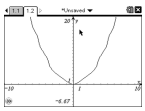
y' undefined if

$2-\cos y = 0$

$2 = \cos y$

never, ever

Graph the curve using parametric equations



solve for x: $x^2 = 2y - \sin y$

$x = \pm\sqrt{2y-\sin y}$

$x_1 = \sqrt{2t-\sin t}$

$y_1 = t$

$x_2 = -\sqrt{2t-\sin t}$

$y_2 = t$

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$x^2 - 2xy + y^2 = 4$

1. Find dy/dx

$2x - 2(xy' + y) + 2y\cdot y' = 0$

$2x - 2xy' - 2y + 2yy' = 0$

$-2xy' + 2yy' = -2x + 2y$

$y'(-2x+2y) = -2x+2y$

$y' = \frac{-2x+2y}{-2x+2y}$

$y' = 1$

2. Use dy/dx to sketch a possible graph of the implicit curve.

3. Factor the left side and solve for y. How does this compare with your graph?

$(x-y)^2 = 4$

$x - y = \pm 2$

$y = x \pm 2$

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Prove the power rule for rational exponents

$\frac{d}{dx} x^{\frac{1}{2}} = \frac{1}{2}x^{-\frac{1}{2}}$

$(y)^{q-1} = (x^{\frac{p}{q}})^{q-1} = x^{\frac{p\cdot q-1}{q}}$

$y^q = x^p$

$q y^{q-1}\cdot y' = p x^{p-1}$

$y' = \frac{p x^{p-1}}{q y^{q-1}}$

$y' = \frac{p}{q}\frac{x^{p-1}}{x^{\frac{p(q-1)}{q}}}$

$y' = \frac{p}{q} x^{p-1-(\frac{p}{q}(q-1))}$

$= \frac{p}{q} x^{p-1-p+\frac{p}{q}}$

$= \frac{p}{q} x^{\frac{p}{q}-1}$

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Find the slope of the Folium of Descartes at the points (4,2) and (2,4).

$x^3 + y^3 = 9xy = 0$ p 157

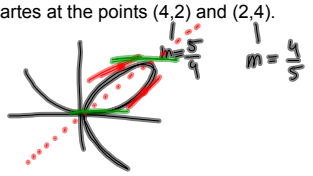
$3x^2 + 3y^2y' - 9(xy' + y) = 0$

$3x^2 + 3y^2y' - 9xy' - 9y = 0$

$3y^2y' - 9xy' = -3x^2 + 9y$

$y'(3y^2 - 9x) = -3x^2 + 9y$

$y' = \frac{-3x^2 + 9y}{3y^2 - 9x}\Big|_{(4,2)} = \frac{-3 \cdot 4^2 + 9 \cdot 2}{3 \cdot 2^2 - 9 \cdot 4} = \frac{-30}{-24} = \frac{5}{4}$



Find the points where the folium has: (a) a horizontal tangent;
(b) a vertical tangent

a) Slope $= y' = \frac{-3x^2 + 9y}{3y^2 - 9x} = 0$ so $-3x^2 + 9y = 0$

$(0,0)$ or $(\sqrt[3]{2}, \sqrt[3]{4})$

b) $3y^2 - 9x = 0$ vertical tangent

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